# VII. COSY – 2d Homonuclear Correlation

(21-Jul-01)

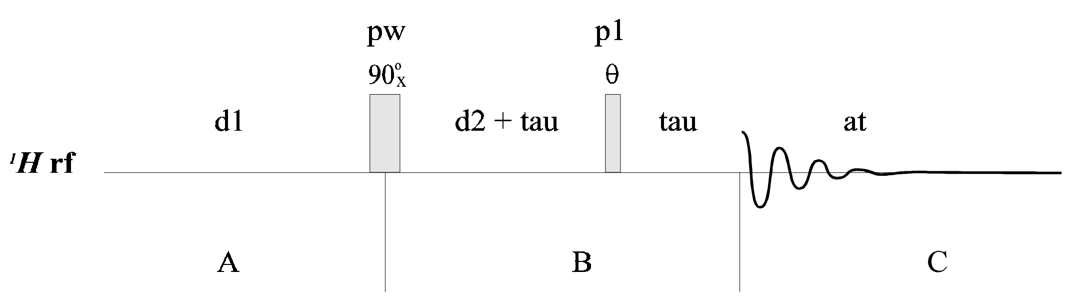
## *A. Discussion*

- Absolute value mode COSY often provides sufficient homonuclear correlation data in a very efficient, robust experiment.
- $J_{HH} \geq$ 4 Hz can typically be observed, but this is dependent on **sw** and **ni**

  $$digital\ resolution\ in\ F2 = \frac{sw}{np} \qquad digital\ resolution\ in\ F1 = \frac{sw1}{2ni}$$

  assuming zero-filling only in F1 (not common in F2). For very large ni, very small couplings can be observed—often well below the linewidth of a high-resolution 1D experiment.
- A common rule-of-thumb is that $J_{HH} \geq$ *dres1/3* will be observed in a COSY spectrum; this estimate is definitely a guideline only. *dres1* ≡ *digital resolution in F1* defined above.
- The most efficient method of observing small $J_{HH}$ is with long-range COSY, which involves this sequence and **tau** > 0 (typically **tau** = 50-200 ms).
- **cosy** loses sensitivity from the strong resolution enhancing sinebell (and sinebell-squared) apodization functions used to overcome the absolute value processing. Even so, minimum phase cycling (**nt**=4) usually gives sufficient sensitivity. GCOSY is even faster (**nt**=1, **nt**=2 is better).
- DQF-COSY (next section) removes all singlets, and gives much cleaner diagonals. Use this sequence after a COSY if crosspeaks close to the diagonal or on a strong singlet region are needed.
- **gcosy** is preferred if a PFG (e.g., hcx or bbswg) probe is installed. **nt=1** can be used with this sequence, reducing total acquisition time by 4.

### 2d Absolute Value COSY (relayh)




## *B. Critical Parameters*

| | |
|---|---|
| **p1** | = 90° for maximum sensitivity; 45° (typical) to reduce intermultiplet crosspeaks |
| **ni** | = usually set satisfactorily by cosy macro; sw1/2ni gives usable resolution; must have ≤ 12 Hz, but want ~ 6 Hz if time allows for best results |
| **nt** | = 4 is minimum phase cycle |
| **sw** | = set using **movesw** macro (preceeded by boxing selected area of spectrum) |
| **sw1** | = must equal **sw** for **foldt** macro (commonly used; recommended for fast-COSY) |

**tau** = set 50-150 ms typical for long-range COSY
**d1** = best set ≥ $2 \times T_1$, but often run with **d1** ~ $T_1$

### *C. COSY 2d Acquisition*

- for COSY, setup as in $^1H$ 1d and optimize **sw** with the **movesw** macro, then retake the data to ensure **sw** is set correctly
  - move the parameters: assuming you ran the $^1H$ in exp1 and have nothing important in exp2, the command **mp(2) jexp2** entered from exp1 will work
  - from exp2 then use SETUP SEQUENCES COSY or enter the macro **cosy** or **gcosy**
  - check that **ni** (sw1/2ni ≤ 12Hz/pt, ~6Hz/pt if time allows) **d1** and **np** are correct (check **time**), then enter **au** to run cosy

### *D. Calibrations*

- can use facility pulse width calibrations; COSY is very forgiving with pulse widths
- even so, performing a **pw90** calibration is always recommended for all 2d experiments

### *E. 2d Data Workup and Plotting*

- COSY data can be processed with the **do2d** macro, or use the **wft2d** command (see also **man('cosy')** or **man('gcosy')**
  - **do2d** applies symmetrization with the **foldt** macro

- general display and plot commands

**dconi** ; displays 2d's with color map (faster than contours)

plot projections before issuing the following command using menus (use the PLOT button)

**pcon** ; plots contours
**pconpos** ; plots phase sensitive contours with positive peaks having 10 contours and neg peaks having 1 contour
**pconneg** ; opposite of pconpos

**plot2dhr** ; plots with high-resolution traces (must have 1d in another experiment)